THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

Publishing Office, No. 42 Pine Street.

Devoted to the Interests of Illumination, Heating, Ventilation and Sanitary Improvement, Domestic Economy, and General Science.

VOLUME XVII.—No. 1. o. 310. | NEW YORK, FRIDAY, MAY 2, 1873. | $3 PER ANNUM IN ADVANCE.

[Original Communication.]

Fluorescent Relations of Certain Solid Hydrocarbons Found in Petroleum Distillates.

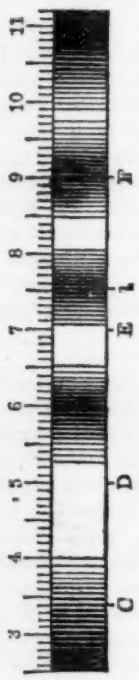
[By HENRY MORTON, Ph. D., President of the Stevens Institute of Technology.]

OBSERVATIONS.

SPECTRUM BY FLUORESCENT LIGHT FROM SOLID THALLENE.

When a portion of the yellow crystalline substance above described, and which, to avoid circumlocution, I shall hereafter call Thallene, in allusion to the brilliant green color of its fluorescence, is examined in the manner first described and represented in fig. 1, we obtain a spectrum such as is indicated in fig, 5.

FIG. 5.



This begins with a very broad bright space in the orange and yellow; then, separated by shades or bands of less brilliancy, follow two green spaces, and lastly one of blue. much less brilliant than the others, and best seen when the violet glass is added to the blue tank (see fig. 1). The scale employed in the above and subsequent drawings of spectra, is that with millimetre divisions introduced by Bunsen.

This spectrum it will be seen differs from that of impure anthracene, or chrysogen as found in commercial anthracene, in two respects. First there is no decided separation of the orange and yel'ow rays from the red, by a dark space in this thallene spec trum, as in the other. Second, there is found in this spectrum a strong bright band in the blue, under circumstances in which it cannot be recognized (if present at all) in the spectrum given by the former substance.

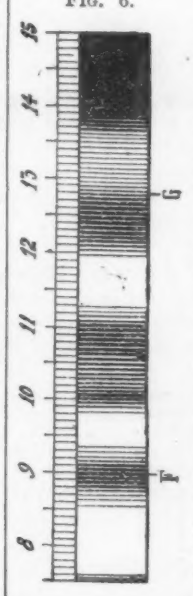
ABSORPTION SPECTRUM OF SOLID THALLENE.

At a temperature of about 460° Fah. thallene fuses without decomposition, and we may thus obtain a translucent plate of it between slips of mica, or on glass, in a condition convenient for the study of its absorption, in the manner shown in fig. 3. But we may also dissolve it in melted paraffine, or spread it by rubbing on filter paper, or mix it with varnish, and so coat paper with it. In any of these shapes when examined by transmitted light, as in fig. 3, it shows an absorption spectrum, such as is represented in figure 6.

In this we find a very strong narrow band, having the line F in its centre, then a less defined double band at 10 and 11 of the scale, another yet less sharply defined from 12 to 13, connected by a shade with the point about 14, where the absorption becomes total. The marked difference between this and the absorption spectrum of commercial anthracene, consists in the double character of the second band, and in the much lower position of the third band which ends above, about where that of the anthracene begins.

We will now pass to the method of observation indicated already in fig. 4.

FIG. 6.



The screen upon which the pure solar spectrum was thrown, located at E (see fig 4), was prepared as follaws: A piece of filter paper was coated with pure thallene by rubbing it on in powder with the finger. It adheres very well to paper, and produces in this way a very regular and beautiful surface. A strip of this is attached with gum to a piece of white card, and this slides in horizontal grooves in a frame E (fig. 3), which is pierced by a large opening.

The spectrum is so adjusted as to fall on the fluorescent strip, and also on the adjacent part of the card, and we have the appearance indicated in fig. 7, where S T represents the part of the spectrum which falls on the thallene-covered paper, and R V that portion which falls on the card. The spectrum upon the card runs of course from red to violet, but even below the fixed line G, becomes very dim, and between G and H ceases to show any decided light. Where these higher rays fall upon the thallene, however, in place of becoming less brilliant towards the upper end, they glow with remarkable intensity, and all about 14 we find a brilliant green ground on which the lines H H' and others, appear with beautiful distinctness.

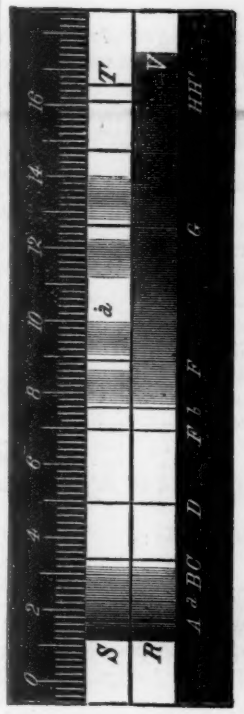
Below this the color is a blueish white, as far as a little below F, beyond which there is no fluorescent action, and the spectrum looks alike where it falls on the thallene and on the card.

The brightness of the spectrum on the thallene is not, however, uniform between 8 and 14, but presents a series of graduated maxima and minima, which are represented in the woodcut, fig. 7.

To measure the positions of these maxima, the following simple device was employed. A pin-hole was pierced in the fluorescent paper, at some convenient point as at *a*, fig. 7, and by sliding the entire card or screen in the grooves which supported in this pin-hole was brought to the part of the spectrum whose location it was desired to fix. For example, as in the figure, at the middle of the broad maximum. Then the spectroscope being placed behind E, the refrangibility of the light passing through the pin-hole is directly observed and measured.

A comparison of fig. 7 with fig. 6, bearing in mind that the scale of the latter is double that of the former in actual dimensions. though the numbers correspond, will show that the maxima in fig. 7 exactly correspond with the absorption bands in fig. 6.

FIG. 7.



This indicates that the absorption in this case is in very close relations to the fluorescence of the substance, and to this conclusion many phenomena to be presently noticed, give confirmation. That such a connection should exist is eminently natural, since those rays which expend their force in fluorescence, *i. e.*, in producing vibrations of a less rate, must evidently disappear; but it does not follow that all rays which are absorbed develop fluorescence; and so, as in the uranium salts, we may expect to find absorption bands which have no immediate relation to fluoresoence, although here also there will always be a special absorption corresponding to the maximnm of fluorescence—exciting power. This was observed by Stokes at the outset. What we have to notice here is that this body, thallene, has no appreciable absorption other than that due to its fluorescence, or in other words, that nearly all the rays absorbed by it are converted into fluorescent motions, and not into those of heat.

I have spoken only of the rays as high as H', when referring to the fluorescence excited by a pure spectrum on a screen of thallene, but it must not be supposed that this is the upper limit of the effect. With lenses and prisms of quartz, I have projected on such a screen a solar spectrum, showing the fixed lines far above.

The fluorescence excited by rays about and above H, does not however seem to suffer any change in intensity, but yields an uniform and brilliant green light, on which the solar lines are seen with admirable distinctness Indeed, this substance seems to me

to surpass any heretofore known as a screen for the study of the violet and extra violet rays.

THALLENE IN SOLUTION.

As has been already noticed, thallene is soluble in a number of liquids, and in all cases it communicates a strong blue fluorescence to the solvent, or more strictly, fluoresces strongly with a blue color in solution.

When this blue fluorescent light is examined with the spectroscope, it is found like the green fluorescence of the solid to break up into bands, but in the solution these are found in all cases to be displaced strongly towards the upper end of the spectrum, which at once explains the change of general tint in the light, from green to blue.

FIG. 8.

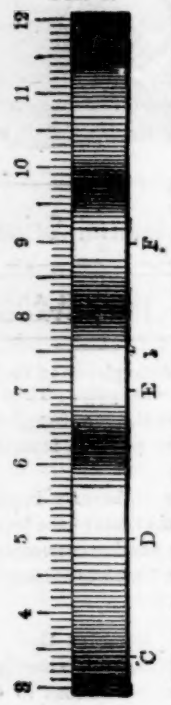


Fig. 8, which represents the spectrum of the solution in benzole will, by comparison with fig. 5, indicate this change, and we shall see that the three most distinct bright bands at 6.8, 8.4 and 9.8 in the spectrum of the solid, are moved to 7.1, 8.9 and 10.7 respectively, in the spectrum of the solution.

If, in place of benzole we employ chloroform as a solvent, we find that the bands occupy sensibly the same positions, but if sulphuric ether is used the bands are somewhat more displaced. With turpentine the displacement seems to be a little less than with ether, and with alcohol about the same, while with olive oil an intermediate position is occupied, and with carbon bisulphide the displacement is least of all.

The following table will give some measurements of the positions of corresponding bands in various solutions:

Carbon Bisulphide.	Benzole and Chloroform.	Olive Oil.	Turpentine.	Ether.
6.80	7.16	7.29	7.29	7.38
8.76	8.85	8.96	8.98	9.04
10.00	10.78	10,92	10.81	

[To be continued.]

Foreign Coal.

The importations of foreign coal for the year ending June 30, 1872, were as follows:

From Dominion of Canada, tons	154,092
Other British North American possessions	103,355
Other countries	233,184
Total tons	490,631

The value of the coal imported at shipping ports was $1,291,206.

The exportations were as follows:

Anthracite, tons	259,537
Bituminous	141,341
Total tons	400,878

The value of the coal exported at the shipping ports was $1,376,342, showing that our foreign coal trade is nearly equally balanced.

Of the quantity exported we sent 170,644 tons of anthracite to the Dominion of Canada, and 120,403 tons bituminous; in all, 291,047. We also sent upward of 36,000 tons to Cuba, upward of 18,700 tons to China, and 27,000 tons to the States of Columbia. —*Coal and Iron Record.*

Obituary—Mr. Grafton Douty.

We learn from the *Ohio State Journal* of the death of Mr. Grafton Douty, which sad event took place on Tuesday night, April 22. Mr. Douty had been a citizen of Columbus for 23 years, and was widely known and respected. He was for many years superintendent of the gas works in that city, and held that position up to the time of his death; but since the middle of February last he was prevented by ill health from giving his personal attention to business.

Chemical Repertory.

No. 91.—May 2, 1873.

EDITOR—HENRY WURTZ.

CHEMICAL EXCERPTS.

704. ANILINE-GREEN DYE ON STRAW.—The straw is laid for some time in boiling water and then washed in cold water. It is next bleached in a bath containing 20 grammes of chloride of lime, and 7 to 9 grammes of sulphuric acid. No more water is used than is needful to give sufficient room for the straw to be well covered and turned about. It is then well washed in cold water. A mordant is then made up of sumach, alum and tartar. In this it is well worked, and allowed to steep for 15 minutes. Half the mordant is then run off, and the vessel is filled up with pure water. The straw having been taken out, aniline green, and, if necessary, picric acid, are added, and the straw is worked in till the right shade is obtained.—*Iron.*

705. HYDRAULIC APPARATUS FOR STORE SHUTTERS.—A plan for closing store shutters by hydraulic power has recently been invented in France. The shutter, composed of horizontal iron laths, is suspended from below on two chains, one of which, after passing over a pulley, supports a piston moving in a hydraulic cylinder. By turning a cock, the water flows from under the piston, which, by its excess of weight, raises the shutter. When the reverse operation is performed, the cock is turned so as to admit the water in the lower part of the cylinder, the piston rises and the shutter falls.—*Scientific American.*

706. ACTION OF COAL SMOKE ON VEGETATION.—Prof. A. Stoeckhardt has made some experiments on this subject, from which he concludes that the injury done to vegetation by smoke is due to the sulphur in the fuel consumed, At a distance of 2000 feet, the most sensitive plants are unaffected by masses of smoke. Trees differ greatly in their sensibility to the action of smoke; pines and firs being affected more easily than fruit trees, which, in turn, are more sensitive than the hazel nut, horse-chestnut, oak, ash, linden. The alder, poplar, and mountain ash, are the most hardy in this respect.—*American Artisan.*

707. LUBRICATING POWERS OF DIFFERENT MATERIALS.—By a machide recently employed in France, for the determination of the lubricating powers of different materials, and known as Napoli's machine, the following results were obtained:

Oil Employed.	Length of Time.	Work absorbed. in Kilos.	Increase temp. during experiment.
Animal Oil	2 hours.	5,200	10°
Oil (Duron)	2 "	2,700	7
English Oil	2 "	1,133	13
Whale Oil	5 "	7,000	10
Impure Colza	2 "	1,000	0
Different	2 "	7,001	41
Samples	1 h. 50 min.	8,409	32
.....	2 hours.	8,700	48
		8,650	43

708. NITRIC ACID IN SPRING WATER.—Professor A. Wagner.—The contents of the Munich waters in nitric acid for several months are given in a tabulated form. Calculating the nitric acid as in combination as saltpetre, the amount of water used by the ordinary water pipes, would contain 679,000 kilogrammes saltpetre, if taken from the wells in the city would contain 4,071,200 kilogrammes saltpetre, sufficient in the first case to make 18,106 cwt. of gunpowder, and in the second case to make 101,568 cwt. gunpowder. —*Amer. Chemist.*

709. EXTINGUISHING FIRES BY VAPORS.—In our description of the Babcock self-acting tank, published on page 143 of the current volume, it is pointed out that "the gas seems to interpose a wall of non-conducting vapor between the hoseman and the fire, which protects him from the heat." A correspondent, W. M., refers to Prof. Tyndall's work, "Heat Considered as a Mode of Motion," in which the fact is stated that the arresting power of carbonic oxide to heat rays compares with the similar resistance of the air to such rays as 75° to 1; and carbonic acid compares to air as 752 to 1. The apparent wall of vapor is, therefore, a scientific fact.—*Scientific American.*

710. EXPLOSION OF GAS IN A THEATRE.—Whilst the drama of "The Jewels" was being performed at the Blackburn Theatre on Monday evening, Feb. 24, two india-rubber bags, containing gas, and used in connection with a lime light apparatus, exploded, blowing a man named Charles Whittaker and a platform about 16 feet high on to the stage. Whittaker received a severe scalp wound and other injuries, and was rendered insensible. The platform was scattered in fragments about the stage, and all the lights in the theatre were extinguished simultaneously with the explosion. The utmost confusion prevailed, and a rush was made to the doors by the audience, but the police and doorkeepers prevented egress, and ultimately succeeded in restoring order. Two women had to be carried out of the pit in a fainting condition. Order having been restored, the performance was resumed.

711. THE TEMPERATURE ABOVE THE CLOUDS.—M. Tissandier states that in a late balloon ascent from Paris he reached a height of 6,500 feet above the earth, where, having passed through layers of clouds, he found a bright sunlight sky and a temperature of from 63° to 65° Fah. When descending and re-entering the clouds, which were in a highly electric state, the temperature decreased to 27°, and the balloon was surrounded by small crystals of ice.—*Sci. American.*

712. CONSTITUENTS OF COMPRESSED COAL-GAS.—M. Caventou.—The author is engaged with researches on the condensed substances met with in the *gaz comprime*, as delivered to consumers in Paris. Some of the liquids condensed emit gas (become vaporized) at 0°; among them the author notices crotonylene, $C_4 H_8$. Its combination with bromine is a solid compound, insoluble in water, soluble in ether and alcohol, fuses at 116°. By the reacting upon acetate of silver an ether is formed from the bromide.

713. PRESERVATION OF EGGS.—A. Gafford.—The fresh eggs are carefully placed in a mixture of 5 kilos. of alum dissolved in 5 litres of water, heated to form 45° to 50°, and left in that liquid for from thirty to forty minutes; the eggs are next drained, and in the meantime the solution of alum is heated to boiling-point. The eggs are again immersed in the liquid, and kept therein for from ten to fifteen seconds; after having been drained and cooled they are packed in either dry bran, sawdust, cork-dust, sifted ashes, or in cotton-wool, and may be kept fresh for a whole year.—*Chemical News,*

714. MAKING BUTTER.—In olden times, says a foreign journal, butter-makers never concerned themselves about the temperature at which the butter was made, but continued to churn, perhaps for hours, until butter came, without being able to tell why the same operation, a few days before, required but half an hour. More recently, however, it was decided that a temperature of 77° Fahr. was the most favorable to butter-making. Still more recent experiments have shown that the temperature should never be higher than 59°, or lower than 55°. To determine this point, a thermometer is absolutely indispensable, and being both cheap and easily understood by any one, there should certainly be one in every dairy.—*American Artisan.*

715. INDELIBLE MARKING INKS.—Take equal parts of very finely pulverized sulphate of iron (green vitriol), and cinnabar, sift them, and triturate carefully with good linseed oil, and finally pass through straining cloth. It can be used immediately. If enough oil is added, it becomes thin enough for writing with a pen; when less oil is employed, it becomes thick enough for use with a marking stamp. Dr. Elsner

has used this ink for cotton goods that were afterwards bleached in a regular bleaching establishment, without injury to the marks.

716. A Coal-Viewer on the Prospects of Gas Companies.—A meeting of managers and under-viewers of collieries was held recently, in the assembly-room of the Old George Hotel, Leeds. There was a very large attendance, and the proceedings were of a highly interesting character. After some preliminary business had been transacted, the opening or inaugural address was delivered by Mr. C. Bradley. That gentleman, in the course of his remarks said: "Recently the question of the duration of our coal fields in connexion with our increasing consumption of fuel has led to a considerable controversy, and I may say that I by no means agree with Sir W. Armstrong in some of his views on the subject, for it is impossible that the present rate of increase can go on for any number of years, and that for many reasons. In the first place, I find that upwards of one-ninth of the entire quantity of coal raised is used in the manufacture of gas, yet a far more brilliant and powerful light is obtained from the magnesium wire and by electricity, and it is not saying too much that in probability in less than a quarter of a century from the present time coal-gas as at present known, will be numbered with the things that were, for as surely as that mode of lighting superseded the oil lamp, so also will it be superseded by a far more powerful illuminating agent."—*Iron.*

717. Action of Chloride of Zinc upon Paper.—When paper pulp is treated with chloride of zinc and subjected to pressure it becomes hard and tough. The hardness and toughness may be varied according to the strength of the zinc solution, so that it is affirmed the material produced will be flexible as leather, or as rigid and tough as wood. The material thus formed takes color readily, may be used as a floor cloth, or as a substitute for leather, for both soles and uppers of boots. It can be fashioned into pipes for gas, handles for whips, saws and other tools, into buttons, combs, pulleys, etc., and into large sheets for roofing. Paper already manufactured may be toughened by being passed unsized through a chloride of zinc bath.

718. Oil Mordant for Aniline Colors.—In some factories an oil mordant is prepared by dissolving carefully 4 pounds of olive oil in 15 pounds of alcohol, and adding 11 pounds of water and 1 pound of sulphuric acid. The whole must be shaken up thoroughly till a milky emulsion is formed, and not a drop of oil is visible on the top of the liquid. The cotton is generally dried after the application of this mordant, and then dyed in aniline colors.

719. On the Solution of Carbonate of Lime by Carbonic Acid.—Th. Schlœsing.—The author concludes: (1) that in presence of carbonate of lime in excess, and an atmosphere containing a constant proportion of carbonic acid, water dissolves at the same time free carbonic acid, neutral carbonate, and bicarbonate of lime; (2) that the solution of the carbonic acid takes place as in pure water, conformably to the law of absorption in the absence of the carbonate; (3) that the solution of the neutral carbonate takes place as in pure water in the absence of the carbonic acid; (4) that the proportion of bicarbonate depends for a given temperature, upon the tension of the carbonic acid contained in the gaseous atmosphere, and follows a law to be hereafter elucidated.—*Chemical News.*

720. Steam and Fire.—A writer in the *American Artisan* says: Our steamers ought to be used for supplying steam in nearly every case, instead of water. Through a few small apertures, such as those left for policemen to peep through, a large space might be completely filled with steam in a few moments, driving out all the air, and leaving nothing but heat behind, the flames having nothing to feed on, while what property is not burned, is uninjured. The carbonic acid patent machines are all well enough, but if each room in every building was furnished with gas-pipes, all left open to the outside, to which steam could be attached as soon as it could be supplied, very few large buildings need burn down in cities. The steam could be ready much sooner than water. If the fire was below, it could be put out instantly. If in the roof, it could be kept from coming down at all, and be speedily controlled. The first requisite in extinguishing fire, is to keep the building closed, and the air from the flames as much as possible. The next should be to fill it with steam instantaneously. Under these circumstances, the fire must go out, with scarcely any destruction, except what is actually burned.

721. Variety in Colors.—New tints of the various colors are constantly being discovered. Over 2000 established shades have already been produced for the dyer's art, and the number is constantly increasing. Among the forty or more shades of blue, scarlet, crimson and yellow, there are hues which were wholly unknown a few years ago, and for which it has been necessary to coin an arbitrary name, as they resemble nothing previously known. Every little while the popular fancy demands a new variation, and colors must be mixed and blended until something entirely novel is produced. It may be pretty or otherwise—that is regarded of comparatively little importance, provided it is the *style.*—*Min'g and Sci. Press.*

722. "Britons Never will be Slaves."—It is a curious fact that in Scotland the coal miners of one hundred years ago were slaves of the soil, and only by claiming a legal decree, received their freedom from abject serfdom in 1775, by the Act of Parliament 15 George III., cap. 28. But it is a remarkable proof of the degrading influence of bondage, that many collieries were so indifferent to liberty that they would not put themselves to the trouble of obtaining the legal decree from the Sheriffs' Courts. In consequence another Act was passed, viz., the 36th George III., c. 56, to take off the bondage completely.—*Iron.*

Removing Boiler Incrustations.

The *Oneida Circular* contains the following interesting account of experiments with tannate of soda to prevent incrustations in boilers:

Something more than a year ago our attention was called to an article in the *American Chemist*, on the subject of boiler incrustations and the best method of removing and preventing the formation of scale in steam boilers. The writer was a practical chemist, and treated the whole subject on scientific principles, giving the result of actual tests and experiments.

Our ten years' experience with hard water had given us a taste of what we were to expect in future in the line of labor and expenditure, unless some remedy could be found which would effectually check the rapid destruction of our boilers from the deposits of lime. We were having no end of trouble from the leaking and burning of boiler-tubes, to say nothing of the increased amount of fuel used and dangers of explosion which are very much increased by incrustation. We at once ordered a quantity of the necessary material, tannate of soda, and began using it. It required some little time before we could discover any effect produced, owing to the very heavy deposit of hard scale with which our boilers were coated. But in the course of a month we observed that our boilers required less coal to keep up steam, and otherwise seemed to do their work without so much driving. Upon examination we found the tubes perfectly free from scale, and in as good working condition as when first put together.

Last June we started a new thirty-horse power Densmore boiler. This boiler has been in constant use ever since, using nothing but the hardest kind of water. Having occasion lately to open it we found the tubes perfectly clean and free from scale of any kind. The inventor of the boiler, who was present at the time, was much surprised at the result, and declared he had never seen anything like it before in all his experience in making and using boilers.

In regard to the amount of tannate necessary, much depends upon the character of the water used. At the rate we are now using it the cost per annum is about $66 for three 30 H. P. boilers. But as we use considerably less during the summer, when we can get more soft water and require less steam for heating, the annual outlay will not be much over $50.

Now how much do we save by the use of this agent?

In the two boilers at the house we use about $2,500 worth of coal per annum, reckoned at last year's prices, which were below the prices paid any previous year. As near as we can now estimate, the cost of coal used in the Densmore boiler is about $375 per annum. Now, according to our best authorities on the subject of steam and economy of fuel, a deposit of scale 1-16 of an inch thick will increase the amount of fuel required 15 per cent.; a deposit ¼ of an inch thick will increase the fuel 50 per cent.; a deposit ½ of an inch thick, 150 per cent., and so on. From careful observation we feel warranted in assuming that by the use of tannate of soda in our Root and Phleger boilers we save at least 20 per cent. in fuel; and in the Densmore boiler, which has to use very hard water, 25 per cent. This being allowed, it is plain that $2,500 is 80 per cent. of the amount of coal which we should have used to produce the same results without the tannate; $2,500 at 80 per cent. would be $3.125 as the cost of the coal required in these boilers with a scale less than ⅛ of an inch thick. A saving of 20 per cent. would be equal to $625 in these two boilers.

In the Densmore boiler we have a present cost of $375 as 75 per cent. of the cost without the tannate; $375 as 75 per cent. would be $500 per annum as the cost of the coal without removing the scale in the boiler. A saving of 25 per cent. would be $125.

Here then are our figures:

Saving in coal per annum in three boilers	$750
Cost of tannate of soda per annum at highest rates	66
Balance in favor of tannate of soda	$684

To make sure that we are within limits we will call the saving in the two boilers at the house 15 instead of 20 per cent.; and in the Densmore boiler 20 instead of 25 per cent. This would reduce our total amount saved to $492.

A New Railway Brake.

The Chicago *Railway Review* contains the following description of a new atmospheric railway brake, invented by T. E. Sickels, chief engineer and superintendent of the Union Pacific Railroad, and designed to remedy the objections to the Westinghouse contrivance, and especially the use of air pressure to *supply* the brake.

Mr. Sickels, in his apparatus, uses a spring to apply the brake, and the air pressure to *take it off*. The normal condition of the train is with all the brakes applied by action of the springs. If the engineer wishes to *start* the train he lets on the air pressure, which detaches the spring and leaves the wheels free to move; the pressure is kept upon the pipes, and so long as this is done the brakes are kept released.

To *apply* the brakes, a portion of the whole of the condensed air in the pipe is let off, and the action of the springs applies the brake.

If there be any defect in the connecting pipe, the result cannot be serious, the only effect being that the train cannot be started, and the engineer must stop and repair the pipe, and re-establish the air pressure before the wheels can run. In the Westinghouse apparatus the engineer has to find out defects by trying to *stop* instead of *start* the train, and the knowledge may be obtained at fatal cost. Suppose, with Sickels's apparatus, that the train breaks in two, the break lets the air out of the pipes, the springs apply themselves to each car, and the entire train is brought to rest.

The entire train is under the instant control of either the conductor or the engineer. By having a cock in each car leading to the air pipe, the conductor —an accident having occurred to any portion of the train—can apply the brake from *any* car to the *entire* train; and this he can do as gradually or suddenly as he pleases, by regulating the discharge of air from the pipe. The brake is automatic in case of a break in the train; the conductor (or a brakeman or passenger, for that matter) can apply it, and the train cannot be run unless the apparatus is in order.

On the Style of Gas-Burner for Bending Glass Tubes.

By H. Carrington Bolton.

Professor J. Lawrence Smith, in a note "On Bending Glass Tubes for Fitting Apparatus (*Chemical News*, vol. xxv., p. 175), recommends a Bunsen burner flattened at its extremity so as to give a thin, broad flame. This is certainly a great improvement on the commonly employed burner, but an ordinary fish-tail or bat-wing gas burner will be found to give, if possible, still better results. The writer has employed for some years an ordinary bat-wing burner attached to a small, short stand (3 inches high, burner included), so as to rest low upon the table, in order that raising the arms inconveniently high may be avoided. Such a burner insures a broad flame, by which the tube is heated for two or more inches in length; the tube is turned while in the flame, and removed for bending as usual.

The deposit of carbon, which, at first sight, might seem an objection, is really one of the chief advantages of using this burner. On placing the glass in the flame, the deposit begins immediately and prevents too rapid a rise of temperature and consequent cracking of the glass; during the heating the carbon tends to distribute the heat equally over the surface of the tube; and, finally, on withdrawing the glass from the flame too sudden cooling is prevented, and the glass is, as it were, annealed.

The black deposit is readily removed by a dry cloth This plan was commonly employed in Hoffman's laboratory, Berlin. In bending tubes of more than three-eighths of an inch in diameter, one end should be closed tightly with a cork (or wax) and air blown into the other end at the moment of bending the tube; by regulating judiciously the pressure of the air upon the sides of the somewhat softened tube, the latter will retain its proper calibre. This cannot be effected, however, with very large tubes, or with very thin ones, which require the nice manipulation of the professional glass-blower.—*Am. Chem.*

Table of Pressures, Temperatures, and Volumes of Compressed Air and Permanent Gases.

[Prepared, by request, for the *American Artisan*, by Prof. R. H. Thurston, of the Stevens Institute of Technology.]

One hundred cubic feet of air at atmospheric mean temperature (60° Fahr.) and pressure (14.7 lbs. per square inch) undergoes change of volumes without gain or loss of heat.

The resulting temperatures and volumes are entered in columns B, C, and D, and the pressures in columns A and F.

An equal quantity is similarly compressed, but with its temperature maintained at 60° Fahr. The resulting changes of volume are given in column E.

Temperatures are measured in Fahrenheit degrees, and are reckoned from the absolute zero in column B, and from the zero of Fahrenheit's scale in column C.

Volumes are in cubic feet.

Pressures are given in pounds per square inch above vacuum, in column A, and above a point fifteen lbs. higher in column F.

The weight of one cubic foot of air, as taken at mean atmospheric pressure and temperature is 0·076,-391 pounds avoirdupois. At the freezing point it is 0·080,728, if at atmospheric pressure, its weight varying, under constant pressure, inversely as the absolute pressure.

Pressures in lbs per square inch above a Vacuum.	Degrees of Temperature measured from the zero of		Volumes under Temperatures.		Pressures in column A less 15 pounds per square inch.
	Absolute scale.	Fahrenheit.	Variable.	Constant.	
0	0.0	—461.2	Infinite.	Infinite.	—15
5	381.2	— 80.0	215.0	294.0	—10
10	466.1	+ 4.9	131.5	147.0	— 5
15	524.3	63.1	98.6	98.0	0
20	569.9	108.7	80.4	73.5	+ 5
25	608.0	146.8	68.6	58.8	10
30	641.0	179.8	60.3	49.0	15
35	670.3	209.1	54.0	42.0	20
40	696.8	235.6	49.1	36.8	25
45	721.1	259.8	45.2	32.7	30
50	743.3	282.1	41.9	29.4	35
55	764.2	303.0	39.2	26.7	40
60	783.4	322.2	36.8	24.5	45
65	802.1	340.9	34.8	22.6	50
70	819.5	358.3	33.0	21.0	55
75	836.1	374.9	31.4	19.6	60
80	851.9	390.7	30.0	18.4	65
85	867.0	405.8	28.8	17.3	70
90	881.5	420.3	27.6	16.3	75
95	895.4	434.2	26.6	15.3	80
100	908.8	447.6	25.6	14.7	85
105	921.8	460.6	24.8	14.0	90
110	934.3	473.1	24.0	13.4	95
115	946.4	485.2	23.2	12.8	100
A	B.	C.	D.	E.	F.

Absolute Pressures. Pounds on square inch.	Degrees of Temperature above		Volumes with Temperatures.		Pressures in column A less 15 lbs.
	Absolute zero.	Fahrenheit zero.	Variable.	Constant.	
120	958.2	497.0	22.52	12.25	105
125	969.6	508.4	21.88	11.76	110
130	980.7	519.5	21.28	11.31	115
135	991.5	530.3	20.71	10.89	120
140	1002.0	540.8	20.20	10.50	125
145	1012.2	551.0	19.69	10.14	130
150	1022.2	561.0	19.22	9.80	135
155	1032.0	570.8	18.78	9.48	140
160	1041.5	580.3	18.36	9.19	145
165	1050.9	589.7	17.96	9.00	150
170	1060.0	598.8	17.59	8.65	155
175	1069.0	607.8	17.23	8.40	160
180	1077.7	616.5	16.89	8.17	165
185	1086.3	625.1	16.56	7.95	170
190	1094.8	633.6	16.25	7.34	175
195	1103.1	641.9	15.95	7.54	180
200	1111.2	650.0	15.67	7.35	185
205	1119.2	658.0	15.40	7.17	190
210	1127.0	665.8	15.15	7.00	195
215	1134.7	673.5	14.89	6.84	200
A.	B.	C.	D.	E.	F.

The Peoples Gas-Light Company of Albany, New York.

This Company, organized Feb. 5, 1872, under the general law of the State of N. Y., for the formation of Gas Co.'s commenced manufacturing and distributing gas the first of the present month (April), about nine months from the time ground was first broken for the erection of their buildings.

The incorporators of the Company are Nathan D. Wendell, Robert H. Waterman, and Smith Briggs, of Albany, and Richard Merrifield of New York.

At a meeting of the incorporators held on Feb. 6, 1872, the following board of Officers were chosen:

President, R. Merrifield; Vice President, Smith Briggs; Engineer, F. A. Sabbaton; Secretary and Treasurer, N. D. Wendell. At the same time contract was entered into with Henry J. Davison the well known Engineer and Contractor of N. Y. city, for the erection of the works and laying of pipe, and it is safe to say no better arrangement could have been made for the interest of the Co., as Mr. Davison has shown the same spirit of enterprise and liberality that has distinguished him in all former undertakings of the kind, much of the work having been carried on during the coldest weather and at large extra expense.

The plans were made and the work carried forward under the immediate supervision of Mr. F. A. Sabbaton, the present Superintendent of the Troy Gas Light Company, and reflects much credit upon his taste and ability as a gas engineer.

The site selected by the Company for their works is considered a most judicious one, being on the northern extremity of the city limits, immediately on the Erie Canal, and Delaware and Hudson Canal Co.'s R. R., comprising a plot of eight acres, purchased at a cost of $25,000.

The present plant of works embraces the following buildings (calculated for a daily capacity of 500,000 cubic feet of gas) but there is ample room to double or treble that amount.

The retort house is 110 feet by 62 feet and is to have two ranges of 10 benches each, five oval retorts in each bench; ten benches, 50 retorts, being already completed and in operation.

The exhauster house, with boiler, engine, steam pump, etc., is 36 feet square and two stories in height, the lower story containing a 25 horse-power boiler and 8 horse engine, a McKenzie exhauster of 5000,000 cubic feet capacity, and a large size Blake Steam Pump, etc. The upper story is used as a workhop, and above all is a wrought iron tank which is used to supply all the water used around the works.

The purifying house is arranged with two wings, which are used respectively as condensing and washing room, and lime room. The main building is 72 feet, by 44 feet, and the wings 38 feet by 23 feet each. The condensing room contains a multitubular con

denser and washer of five hundred thousand cubic feet capacity.

The main building is to contain 8 purifying boxes, 12 feet by 14 feet square, 4 of them being already in place. Those purifiers rest on wrought iron girders supported by cast iron columns, leaving a clear light cellar beneath.

There is alsso a substantial frame coal house of a capacity of about five or six thousand tons.

The telescopic gas holder, of about 300,000 cubic feet capacity, is surrounded by a substantial brick building with stone trimmings and variegated slate roof. This feature of the works is deserving of special notice, since the custom of covering gas holders is fast becoming popular in latitudes as far north as Albany, and though they are much more common in the Eastern States, quite a number of these buildings have been erected in the State of New York; and, besides presenting a tasteful appearance, their economy in saving condensation of gas, and wear annd tear to gasholders from the action of the elements, must be apparent.

There is also a neat brick office containing a 500,000 cubic feet station meter, of American Meter Co.'s make.

All the buildings are substantially built of brick, with stone and iron trimmings, and will well repay a visit from any one interested in gas matters.

The gas holder, iron roofs, iron doors, windows, etc., were furnished by Mr. T. F. Rowland, of the Continental Works, Greenpoint, L. I. The purifiers, condenser, washer, bench castings, etc., were made by Messrs. Herring and Floyd, Oregon Foundry, N. Y., and the retorts, fire-brick, etc., were supplied by Messrs. Maurer & Weber, of the Manhattan Fire Brick Works, N. Y.

The company have already run their pipes through the principal streets, and as soon as the frost is out of the ground, it is their intention to extend them through all the streets of the city. We are told the Company is meeting with the greatest favor from the inhabitants.

The New York Mutual Gas-Light Co.

The upward progress of this Company since its organization has been simply marvelous. It is only eight months since they have supplied the public with gas, and the consumption has reached the unprecedented (for the time) quantity of 1,400,000 cubic feet in twenty-four hours. The works being originally planned with a capacity of 2,000,000 cubic feet, such a rapid increase of consumers necessitated an enlargement of their works, and they are now building an extensive addition to their already model establishment, from plans and specifications furnished by the urbane and thoroughly accomplished engineer, Mr. Samuel P. Parham.

The company is now erecting a new retort house, the dimensions of whioh are 209 feet by 82 feet. It is calculated to hold 336 retorts, 24 by 13 inches, inside measurement. They are also engaged in erecting three gas holders—making seven in all—each of a capacity of 300,000 cubic feet. It is the intention of the company to change the present naphtha works into the ordinary coal gas system, and to erect a new naphtha department, which will be entirely distinct and independent. The naphtha which is employed in the manufacture of the enriching gas is conveyed in vessels to the wharf, and thence pumped through underground pipes into a large reservoir, capable of holding 15,000 barrels, and in which it is confined previous to being used in the manufacture of the gas.

The well-known contractors, Messrs. Hoy, Kennedy & Co., *designed and built* the works, and Mr. Samuel P. Parham the Chief Engineer, under whose supervision and direction the entire works have been constructed, is the oldest gas engineer in that capacity in this city, and deservedly ranks high in the profession. To him are we indebted for the pleasure experienced in our late visit. The other officers of the works are Mr. J. G. Harper, Supt., and Mr. Henry Hunt, Night Engineer.

Correspondence.

[Correspondents, in all cases, should sign their communications with their names and address in full—not necessarily for publication, but as a guarantee of good faith.—ED.

☞ NOTICE.—Correspondents not intending their letters for publication must mark them "Private."

Further from Mr. Somerville.

KNOXVILLE. TENN., April 26th, 1873.

Mr. Editor: You keep a standing notice in your Journal inviting all its readers who take an interest in the subject to which its columns are devoted, to make it an organ of intelligent discussion amongst them. There can be no doubt that the correspondence columns of the Journal have been of the greatest interest to the gas profession, for my own part I have received from it, from time to time, many valuable hints; but of late it has seemed to me that this part of the Journal has fallen off in interest, many of your most intelligent correspondents have been silent for a long time.

Thinking over this, in a letter addressed to A. M. Callender & Co., I took occasion to point out to them what, in my opinion, I thought was the cause of this falling off, you thought fit to publish this letter. I regret it, for it was not intended for publication by me; but more especially, because it gave an opportunity to Mr. John Keeling to come again to the front.

He talks about free discussion, why its not long since he took occasion, through the GAS-LIGHT JOURNAL, to insinuate that some of your correspondents (I happened to be one of them) were using fraudulent meters, knowing them to be so. In his last communication but one, he falsely imputes motives to your English correspondent, Mr. Ohren; and in the last issue of the Journal he states that 50 per cent. of the gas managers in this country are incompetent, or in his own words, "never saw a gas works until they took charge of their present homestead." Now if these impudent assertions are what he calls free discussion, then I, for one, want none of it. This sort of thing may be termed free discussion in England, where he says he comes from; but I can inform him it is not so here. If he will turn to the correspondence columns of your contemporaries, the *American Artisan*, or the *Scientific American*, he will find the most inimitable courtesy and gentlemanly feeling pervading the whole. He also says he will endeavor to merit the title of a professional gas agitator. I believe him. A gas agitator is one who makes his living by stirring up trouble between the consumer and the gas companies, he is eminently fitted for the position. I am perfectly content that it should be so, and I can only regret that he should be allowed to promulgate his ideas through the AMERICAN GAS-LIGHT JOURNAL.

Yours respectfully,

JAS. SOMERVILLE, Supt.

The Gas Companies.—Peter Woods' resolutions in relation to the gas companies of New York, which were introduced by him on Wednesday evening, 23rd ulto. were taken from the table on the 28th and passed. They recite that the New York Gas Company having failed to supply the city with gas in accordance with their charter, the committee on Cities of the House be instructed to inquire into the practicability of the city manufacturing and supplying its own gas, in the same way that it supplies water. Before the resolutions were adopted, they were amended by referring them to the Committee on Trade and Manufactures, instead of c ties, with instructions to report within ten days.—*Daily Paper.*

The Central Park Meteorological Department reports as follows for the week ending April 5: Range of barometer, 1,100 inches; maximum of thermometer, 59.5 degrees; minimum, 37; total amount of water for week .59 inches; distance travelled by the wind during the week, 1,496 miles.

Bituminous Coal in America.

Starting with Nova Scotia, the most northerly and easterly of our sources of supply, we find a production of coal suitable for gas and steam uses, to the extent of a yearly business of 625,000 tons, the largest being in 1866, when 684,766 tons were produced. The exports to the United States at present do not exceed 165,000 tons, of which the bulk is to Boston and points eastward, where it enters into competition with our Broad Top and Cumberland for steam uses, and our Pennsylvania and West Virginia gas coals in the manufacture of gas. The present quotation of Province coals is $1.60 to $2.25, gold, per ton at the mines, freight to Boston, $2.75, gold, and the duty is 75 cents per ton, gold. The quotation at Boston is $6.25 to $6.75, United States currency.

The following table gives the amounts of coal mined and shipped in Nova Scotia from 1827 to 1870, inclusive:

1827 to 1830	51,172 tons.
1831 to 1840	808,145 "
1841 to 1850	4,405,384 "
1851 to 1860	2,292,305 "
1861 to 1870	5,092,587 "
Total production	9,649,470 "
Production for the year 1870	725,768 "
" " " 1871	673,242 "

Nova Scotia coal was free of United States duty 1854 to 1865, and the average annual production of those twelve years was only 333,427 tons.

The next field is that called the Blossburg, situated in Tioga and Bradford counties, Pennsylvania. The first coal from this region that we hear of coming to market was from the Bloss mines in 1840; from this date it has enlarged, until in 1871 it was 815,079 tons. The producers of this region consist of the Fall Brook Coal Company, Morris Run Coal Company, Blossburg Coal Company—all with mines near Blossburg, Tioga County, Pa.; McIntyre Coal Company. which commenced operations in 1870, have their mines at Ralston, Pa., and Towanda Coal Company, mines at Barclay, Pa. The production of each company up to and including 1871 was as follows:

The coal from the Towanda district:

Barclay Coal Co., 1856 to 1867	410,650
Towanda Coal Co., 1865 to 1871	756,372
Fall Creek Bitu. Coal Co., 1865 to 1871	280,510
Total	1,447,532
Towanda Coal Co	249,210
Fall Creek Bituminous Coal Co	129,095
Total	378,335

	Blossburg.	Towanda.	McIntyre.
1870	733,035	271,325	17,808
1871	815,079	378,335	106,130

The coal sent to market from Blossburg in 1871 was mined as follows:

Fall Brook Coal Co	232,632
Morris Run and Salt Coal Co.'s	385,996
Blossburg Coal Co	196,453
Total	815,079

Since the commencement the coal was furnished from the following points:

From old Blossburg mines, '40 to '59	533,745
" Fall Brook, '60 to '71	1,951,600
" Morris Run	2,842,263
" Blossburg Co., '68 to '71	554,142
Total	5,881,750

The coal from these mines is used for locomotive and general steam uses. The business is managed by a general agent, who divides the contracts made *pro rata* among the various mines. Of a similar nature, as regards quality, is the coal mined by the Fall Creek Bituminous Coal Company, whose mines adjoin the Towanda Company's, the coal passing over their railroad to Towanda, thence by the Pennsylvania and New York Railroad, and the Albany and Susquehanna to Troy, where it is used by Messrs Griswold & Co. The Towanda Company's production is used by the Erie Railway Company.

The next in interest are the bituminous coals from Westmoreland, Clearfield, and Elk counties, which reach tide-water by the Pennsylvania Central and

Philadelphia and Reading Railroad. This coal is used in many of the rolling mills, machine-shops, and other industrial establishments along the line of the Pennsylvania Central and the Philadelphia and Reading railroads. The first that we have record of was in 1858, when 247,491 tons were shipped, and in 1871 the business eastward amounted to 1,787,180 tons; the shipping point for the gas coals is South Amboy, New Jersey. the company preferring it to Greenwich on the Delaware River, as it affords them a better opportunity of putting their coals into the New York and Eastern markets; much of this coal being used by the various gas-light companies of our larger cities. The quotation at Amboy is $7 per ton.

Then we pass on to the Broad Top coal field, which is situated in Huntingdon and Bedford counties, Pa. It finds its way to tide via the Huntingdon and Broad Top Railroad, the Pennsylvania Central, and so on, to Philadelphia, from which point it is distributed to various points eastward. The production began in 1856, 42,000 tons being mined in that year, and during 1871 the business amounted to 319,625 tons. The coal is of rather a semi-bituminous nature, and is used for steam purposes and in glass works, being especially sought after for this latter purpose. The mines are owned by twelve firms or individual operators, and employ 540 men; the improvements are valued at $765,000. During 1871 the shipment of bituminous coal at Philadelphia was 450,000 tons.

The West Virginia gas-coal trade next invites our attention. The business opened up in 1868 with receipts at Balitmore of 165,972 tons, via the Burlington and Ohio Railroad; in 1871 it had amounted to 189,763 tons, and as the coal is of good quality, the business is increasing, and shipments are made to all the Northern and Eastern ports. The quotation at Baltimore at present is $6 per ton.

The next coal field which invites our attention is the George's Creek or Cumberland. This is situated in Alleghany county, Maryland, and finds a connection with tide-water, via the Chesapeake and Ohio Canal, to Georgetown and Alexandria; and via the Baltimore and Ohio Railroad to Baltimore. The first coal sent to market from this region was in 1842, when 1700 tons were shipped, and the amount of tonnage during the year 1871 was 2,345,753 tons, 1,494,818 being via the railroad, and 850,339 via the canal. The producers number about eighteen companies, and the coal is used exclusively for steam uses, either by marine, locomotives, or stationary engines.

This is one of the varieties of coal that a reduction of the tariff on coal comes in contact with at the Boston and Eastern markets, and as the amount of capital invested is large, and the return received therefrom small, it is impossible for these companies to make a reduction of prices.—*Seward's Coal Circular.*

Report of Chief Engineer John P. Culver, of the Bureau of Engineering and Surveying of Jersey City.

[Continued from page 132.]

Most of the piles for the foundation have been driven, and a portion of the capping, stringers, and planking laid. The sheet iron is now being cut into shape and rivet holes punched, and arrangements perected for lining and laying the pipe so soon as the weather will permit.

It is a fortunate circumstance that this new main will be completed this year, for had the extension been delayed it is extremely probable that a scant water supply would have resulted.

In this connection I would call your attention to the fact that various railroads have crossed our conduit lines without soliciting or obtaining any right of way. As additional expense will be incurred in laying the new conduit on account of going under these roads, it would be no more than just that they should at least partially reimburse the city.*

IRON PIPE CONDUIT.

The conduit of 36- inch cast-iron pipe was intended at the time of the awarding of the contract for its construction to terminate on the west bank of the Hackensack River, connecting with the 36-inch main from the receiving reservoir at Belleville; but it will now also connect with the new conduit of cement-lined pipe; thus giving us three distinct mains, two of 36-inch and one of 20 inch diameter, to supply the city with water. The submerged pipe was laid during 1871, and the sections from the west end to the point where it will connect with old main, and from the east end to the new reservoir, finished during the past year. This line has not been tested as yet, and possibly will not be until the continuation to Belleville is completed. Although the testing of each length at the foundry was dispensed with it is hoped that no defects exist, as care was taken that none but perfect castings should be used.

The entire length of this line is 8,629½ feet; being 1,005 feet on west side of river, 1,072 feet on banks and under river, and 6,552½ feet from east side to terminus on Bergen Hill.

RESERVOIR NO. 2.

An accident similar to that described in my previous report occurred last month at the distributing reservoir, and for eighteen hours but an inadequate supply was furnished through the 20-inch "run-around." To quote from such previous report will briefly, in part, explain the matter:

"During the extreme cold weather in the early part of December a mass of slush-ice accumulated against the screens and clogged them; as the water in the well of the screen house passed off through the distributing pipes the outside pressure ruptured the wires, and the ice filling the well, choked the pipes—the pressure solidifying the slush and ice in the well to a mass over eight feet in thickness.

The precaution of erecting a breakwater in front of the screenhouse was taken last summer, but it proved insufficient to save the screens. It was supposed that by so diverting the flow of the 20-inch main that the pressure due to the difference in elevation between the reservoirs could act against the ice it would be dislodged, but in this instance such result was not attained. To remedy the evil that would result from a repetition of this accident the 36-inch conduit is now being connected with the 24-inch supply pipe. While by this means we will be able to furnish the quantity of water commonly required for use without regard to the reservoir, it is probable that the additional force which could be applied would be enough to displace any impediment at the mouths of the effluent pipes.

At the time the Board of Public Works assumed control of the water works, the foundations for building contracted for by the Water Commissioners were nearly completed, but at my request the prosecution of the work was suspended that the advisability of substituting duplex engines for the intended Cornish engines might be considered.

On the 5th of June, 1871, the following report was made by our Consulting Mechanical Engineer and myself:

REPORT ON DUPLEX ENGINE.

"We submit herewith our report relative to the advisability of substituting the Worthington Duplex engines for Cornish engines, for the high service supply of this city.

"Although satisfied from knowledge previously obtained, and the comparison of statistics concerning the subject, that for the use intended in this case there was but little question concerning which engine would be preferable, we yet deemed it best to make a personal investigation and from an actual inspection corroborate such data as have from time to time been furnished concerning the working of the Duplex engine.

"We visited the Mystic water works at Charlestown, Massachusetts, and the Fairmount water works at Philadelphia, and at both places were treated with the utmost courtesy and everything done to facilitate our obtaining desired knowledge. While availing ourseves of the information tendered by those having supervision of the works, we have also examined the mechanism of the engines, and consulted the operative engineers in charge.

At Charlestown, Edward Lawrence, Esq., President of the works, informed us that the Duplex was adopted after a full and careful examination of the claims of the Cornish and other forms of pumping engines, and after using the Duplex for six years he is so well satisfied concerning its superiority that he has recently ordered a third engine of the same pattern but of larger dimensions, for the Mystic works.

"The two engines now in use have a capacity of 5 million gallons each per diem.

"The new engine is to have a capacity of eight million gallons per diem.

"As an evidence of the care with which the engines had been constructed, Mr. Lawrence informed us that the cost of repairs for the six years had been less than one hundred dollars; we were shown one of the pump valves which had been in use four years and was still in good condition.

The duty done in raising water to an elevation of one hundred feet for each one hundred pounds of fuel consumed, was considered by Mr. Lawrence as being fully equal to the best work performed by the Cornish engines under the most favorable circumstances.

"Mr. Graff, the Chief Engineer of the Fairmount water works as well as the entire water works of Philadelphia, a gentleman whose reputation is national, and whose opinion is entitled to the most respectful consideration, informed us that the performance of his best Cornish engine had been equalled by his Duplex engines at Belmont, and the fact that he had ordered three additional Duplex engines is strong evidence of his unqualified preference.

"He says that the Duplex have given him no trouble, the costs for repairs have been so trifling as scarcely to deserve mention, and that their immunity from accidents, due to their mechanical construction, is such that he is relieved from the anxiety and care inseparably connected with the working of Cornish engines.

"The Cornish engine has the sanction of time, and the respectability that naturally clings to established usage, but in this progressive age, rife with the spirit of improvement, its past usefulness cannot guarantee its continuance, nor be used as an argument against the adoption of other engines, if the crucial test of actual duty proves their superiority.

"The Cornish engine, one of the first forms of steam engines, is only properly adapted to the peculiar service in which it originated; the lifting of water from deep mines.

"As the engine was placed on the surface and the pumps deep in the bowels of the earth, long and heavy rods were essential for their connection.

"Power was naturally employed in lifting the weights, and their gravity in falling raised the water to the desired elevation.

"In such service any intermitted action was of but little consequence, and economy in fuel a desideratum.

"The establishment of a system of annual reports excited emulation which resulted in the designs of the engines being improved, and they gradually assumed the perfection at last attained.

"Their high duty finally became celebrated, and in after years, as the demands for pumping engines for water works developed, it was natural that the Cornish engine should be selected, the more particularly as the service was in many respects similar; the water being obtained from pits or shafts sunk through the chalk formations, until the apparently inexhaustible reservoir that underlies so much of England was reached.

"Once used as pumping engines for the water works of towns, modifications adapted them to the conditions in which we are now using them, and so far as economical use of fuel is concerned, they still, under favorable conditions, maintain their reputation, and although equalled, have never been excelled.

"Experience tends to show, however, that in many other respects as essential as economy they are inferior.

"The efficiency of a pumping service of a city underlies the prosperity, comfort, safety, and health of its inhabitants, and such efficiency is dependent to a great extent on the durability of the engines and their freedom from accidents, and on these points the Cornish engines are defective.

"They are in fact the most precarious form of engine known, requiring not only the utmost skill upon the part of the attendants, but are liable to accidents against which it appears impossible to guard, and the immunity we enjoy is no evidence that the works may not be disabled at any time; in proof of which it may be said that there is scarcely a Cornish engine in the country but what has been subject to dislocation and fractures, more or less extensive; which, being due to their form and action, scarcely admits of a remedy.

"The intermittent action of the Cornish engine is a serious argument against its adoption, entailing as it does the necessity for a stand-pipe, a contrivance whose objectionable features do not appear to require much comment, as we have so lately realized the dan

* This paragraph properly belonged to the passages cited in the previous issue from this Report.—ED.

ger incident to such a device, and are about to experience the cost of its maintenance in the construction of the tower at Belleville.

"An immense and weighty column of water in the stand-pipe alternates from a state of comparative rest to one motion of at every stroke of the pump, accompanied with very great and irregular strains upon the pump and contiguous valve chambers and pipes, which when augmented by a slight irregularity in the movements of the valves (liable to occur from accidental causes) become so percussive as to cause serious and disastrous breaks.

"Various attempts have been made to construct new forms of engines in place of the Cornish; notably, the Hartford Cam engine, the Shield engine at Cincinnati, and the so-called Double-Action Cornish engine at Brooklyn, but none of them met with such success as to warrant their introduction, and we believe they have not been duplicated.

"A failure of considerable magnitude was also experienced at Detroit.

"The Worthington Duplex appears to be the engine destined to supplant the Cornish, and from the date of its introduction its reputation has grown and increased, until now its superiority is generally acknowledged by those most competent to decide.

"Seventeen years ago three Worthington engines were put up at Savannah; others of the same kind were erected at Cambridge in the year 1856, which, under careful trial, excelled every other engine in the country, our own at Belleville included.

"The Charlestown engines (being the first of the Duplex form) were erected in the year 1856, and their performance is asserted to be the best on record.

"At Cambridge they have recently put in a second engine of five million gallons capacity, also one at Salem of same size.

"One has been running at Harrisburgh, Pa., almost constantly for ten years with almost no repairs.

"The Duplex is also to be used at Providence, Poughkeepsie, and other points.

"Two are running at the Newark water works, and several others could be enumerated if necessary, but we deem the foregoing sufficient to convince your Honorable Body that in using the Worthington Duplex engine you would neither be elucidating a vague theory nor testing an untried experiment.

"A noticeable feature and valuable characteristic of the Duplex engine is the noiseless way in which it performs its work; there is no concussion nor even an appreciable jar in the engine or its attachments; the piston acting directly on the water without the intervention of vast moving masses of metal, reduces, if it does not obviate, the danger of fracture or dislocation to which the Cornish engine is liable.

"The water-flow throughout the delivery main is so equable as to scarcely disturb a sensitive gauge placed thereon, and the discharge into a reservoir is so uniform as to be without perceptible pulsation.

"The location of two Duplex engines on Bergen Hill will serve equally to render the supply for the upper service plenteous, and to fill the storage reservoir when it shall be constructed.

"Considering the foregoing, and that the present foundation of the new engine house can be utilized, while there will be no necessity for the erection of a stand-pipe and inclosing tower; and that the beam walls and second story of engine house will not be required, it is manifest that the simplest, safest, most durable and inexpensive engine should be selected.

"So that from motives of economy, believing that a great saving can be effected and the work done as well if not better than in any other manner, we would give our most emphatic preference to the Worthington Duplex engines, and recommend that they be used in the new works on Bergen Hill."

The recommendations contained in this report having been adopted, suitable changes were made in the plan of the building, (which is now being completed), and contract entered into with Henry R. Worthington, Esq., for two of his Duplex engines, with boilers and attachments complete. One of these engines, as before mentioned, has been transferred to the pumping works on the Passaic river, the other is now being set up in the building on Bergen Hill.

[To be concluded in our next.]

Ventilation.

The question as to how much fresh air is required for the proper ventilation of a given room is answered by Pinzger in the German *Zeitschrift fur das Bauecsen*, (Journal of Architecture.) He treats the subject analytically and bases his calculations on the fact that a man expires per minute one sixth of a cubic foot of air, charged with 4 per cent carbonic acid, that the expired carbonic acid penetrates uniformly through all parts of the room, and finally, that the pure air introduced in the room mingles with the impure air in the same, immediately to a homogenous whole. Consequently the question what the increase in the percentage of carbonic acid must be after a definite time in a room in which two persons are present, and to which a definite quantity of fresh air is regularly supplied, is easy to ascertain. Inversely the question presents itself how large the quantity of fresh air supply must be in order that the deterioration of the air after a given time may not surpass a certain definite limit. After defining the first fundamental formula, the inbuence which must be the result of the difference in temperature between the interior and exterior air is taken into account after the law of Gay Lussac, and the results are embodied in the following table;

AMOUNT OF FRESH AIR IN CUBIC FEET REQUIRED FER HOUR FOR EACH PERSON.

1. In hospitals:		
a. For ordinary patients	2,000	3,000
b. For injured persons	3,500	4,000
c. During an epidemic	g,000	7,000
2. In prisons,		
3. In factories:		
a. Ordinary factories	2,000	3,200
b. Where the air is contaminated	3,500	5,000
4. In caverns with soldiers:		
a. By day	1,200	1,600
b. By night	1,500	1,800
5. In theatres	1,500	1.800
6. In halls when long occupied	2,000	2,500
7. In halls occupied a short time	1,200	1,600
0. In schools	1,100	1,600

As an ordinary gas flame requires as much air as nine persons, every gas flame in a room or hall must be counted as such, and the air supply rated accordingly.—*Manufacturer and Builder.*

Safety in Coal Mines.

Experiments were lately made in the Catacombs of Paris, to illustrate the efficiency of a new apparatus for preserving the life of miners against fire damp. The experiments, aside from the novelty of the situation, are rendered quite interesting from the strange manner they are carried on. In the center of a large opening is placed a large glass box or chamber, in which is placed a rabbit and a rooster. At the extremity of this chamber is a tin cylinder, closed at both ends, and an india rubber tube inserted in one end. A man dressed like a miner enters the glass chamber which is closed on him hermetically and proceeds to work with a pickaxe as if in a mine. He has on his back a small tin box, like a knapsack. The nostrils are closed by means of a spring like the central part of a pair of spectacles, and he holds in his mouth, the end of a tube which connects with the tin box on his back. He tears up the ground and works around as if in a mine. The knapsack is intended to hold a supply of pure air, and the tin cylinder a reserve fund of the same article. The glass chamber is then filled with carbonic acid gas, which in a few minutes kills both the rabbit and rooster. The lamp on the miners breast burns, as it is supplied also with air from the can, but the torches in the chamber are of course extinguished. When the light of the lantern grows dim he draws upon the reserve fund of fresh air. Hydrogen and oxygen gas are then turned into the glass chamber but have no effect, the lamp being a safety lamp, and he himself being independent of the surrounding atmosphere.

The device is that of Capt. Denarouze, who hopes to introduce it in coal mines particularly. Something of this kind has long been in use, but was not intended for regular work. In cases of emergency, a bag of air was placed on the miners' back, his nostrils closed and a tube connecting with the bag placed in his mouth. By means of this device, however, it would seem as if men could work for some hours, and the knapsack and cylinder replenished as occasion demands. If miners perish of choke damp after this, it will not be through the fault of science.—*Scientific Press.*

The total production of oil in the Pennsylvania oil region for December was 638,712 barrels, or 43 gallons each, being an average daily production of 22,054 barrels, and a daily increase over corresponding month of the year before of 5351 barrels.—*Coal and Iron Record.*

The Late Gas Strike.—We learn from a daily paper of the 1st inst.. that the trouble between the New York Gas Company and their employes is to be looked into that day by the Committee on Trades and Manufactures, who act on authority of the Assembly.

PRICES OF FOREIGN AND DOMESTIC GAS COALS.

[Reported Expressly for this Journal.]

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English Caking Coals.			
Newcastle Gas	$12 00	@	00 00
Liverpool caking	11 50	@	12 00
British Province Coals.			
International—At Sydney, $2 50 in gold			— —
Block House—At Mines, $2 50, Gold			0 00
Little Glace Bay—At Mines, 2 50 Gold			— —
Pennsylvania Coals.			
Penn Gas Coal—At Amooy	$8 50	@	0 00
Westmoreland—At Amboy	8 50	@	0 00
(In New York both the above coals $9 10)			
Shafton	9 10	@	0 00
Youghlogheny—At Baltimore	7 50	@	0 00
West Virginia Coals.			
MurphyRun	$8 00	@	8 75
Despard—At Baltimore	6 30	@	0 00
West Fairmont	8 00	@	0 00
American Gas Coal	8 50	@	0 00
Fairmont	8 50	@	0 00
Newburgh Orrel	8 50	@	0 00
Pinnickinick	8 50	@	8 75
Cloverhill of Virginia	5 50	@	6 00
McKenzie Compound Mixture			— —
American Cannel Coals.			
Peytona of West Virginia	$15 50	@	00 00
Darlington of Pennsylvania			— —
American Cannel	$14 00	@	00 00
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Ritchie Mineral of West Virginia	22 50	@	00 00
Trinidad Bitumen	— —	@	14 50

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FRIDAY, MAY 2, 1873.

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THE ORGANIZATION OF THE GAS-LIGHT ASSOCIATION OF THE UNITED STATES.*

In pursuance of the call (which was published in the last issue), on the 16th of April, at 10.30 A. M., 34 gentlemen answered to their names, representing delegations from the following cities and States:

New York city; Worcester and Springfield in Mass.; Syracuse, Oswego, Buffalo, Hudson, Peekskill, Catskill, etc., in New York; Paterson in New Jersey; Philadelphia and Harrisburgh in Pa.; Petersburgh in Va.; Jacksonville in Florida; Wilmington in Delaware; Cleveland and Toledo in Ohio; Detroit in Michigan; Louisville in Kentucky; Sacramento in California; and Washington in the District of Columbia.

The number of Gas-Light Companies throughout the United States that had been communicated with, and had proposed to send delegations, was about 80; it being impossible of course, with the private means used only, to reach more than a fraction of the whole number.

The assemblage even of so large a proportion of those who had responded, was a matter of surprise and congratulation, considering the great distances and other difficulties; and manifests the interest that is taken in the movement.

ORGANIC RESOLUTION.

This was offered by Mr. De Mill, of Detroit, Michigan, and after some discussion and amendment was passed unanimously, as follows:

Resolved: That it is deemed expedient to organize a National Association of Companies and Individuals engaged in supplying cities and towns with illuminating gas.

On motion of Mr. Steele of Buffalo, a committee of six gentlemen and the President was appointed, to draft a constitution. The President named the following:

Gen. Leavenworth, of Syracuse, N. Y.; Mr. Steele, of Buffalo, N. Y.; Mr. Dwight, of Springfield, Mass.; Mr. William H. Williams, of Philadelphia; Mr. W. H. Price, of Cleveland, Ohio; Mr. H. H. Hoeg, of Jacksonville, Florida.

[Copies of the Constitution, as reported by the Constitutional Committee, and, after some discussion and amendment, unanimously adopted, will be transmitted to all the Gas-Light Companies in the United States.—SECRETARY.]

On motion of Gen. Leavenworth, of Syracuse, a committee was appointed of one delegate from each State, selected from the companies present, to nominate officers for the association.

The following committee was appointed:

From Massachusetts—Mr. Dwight, of Springfield.
From New York—Mr. Steele, of Buffalo.
From New Jersey—Mr. Floyd.
From Pennsylvania—Mr. Myers, of Harrisburgh.
From Virginia—Mr. W. H. Baxter Petersburgh.
From Ohio—Mr. Morley.
From Tennessee—Mr. Kendrick of Nashville.
From Kentucky—Mr. Rankin, of Louisville.
From District of Columbia—Mr. McIlhenny, of Washington.
From Michigan—Mr. Lewis, of Detroit.
From Florida—Mr. Hoeg, of Jacksonville.

and made the following report, which was unanimously adopted.

For President, Charles Roome, of New York.
First Vice President—P. E. Demill, of Michigan.
Second Vice President—W. H. Price, of Ohio.
Third Vice President—Thomas R. Brown, of Pennsylvania.
Secretary—Henry Wurtz, of New York.
Treasurer—J. W. Smith, of New York.

EXECUTIVE COMMITTEE.

O. G. Steele, of Buffalo; James Howe, of Brooklyn; George A. McIlhenny, of Washington; E. W. Leavenworth, of Syracuse; Charles C. Mowton, of New York; with the President and three Vice Presidents, *ex-officio*.

AUDITORS.

Oscar Zollikoffer, Jr., of New York: A. W. Brown, of Philadelphia.

Gen. Roome, returned, with much eloquence, to the representatives of the gas fraternity assembled, his thanks for his election as President of the Association.

Mr. Demill moved that the first annual meeting of this Association be held in the city of New York, on the third Wednesday in October next.—Carried.

On motion of Mr. Williams, of Philadelphia, two committees of three were appointed, on Statistics and on Insurance, the same three gentlemen being appointed on each—Mr. Price of Ohio, Mr. Lewis of Michigan and Mr. Williams of Pennsylvania.

Mr. Lewis moved after signing the Constitution, an adjournment till 10 A. M., April 17th.—Carried.

At the meeting of the 17th, among other proceedings, numerous letters were presented, by Mr. Demill, of representatives of companies unable to be present.

Committees were appointed on Gas Coals, Petroleum Gas, Purification, and Office Business.

The following gentlemen, distinguished in different specialties, were invited by the Executive Committee to deliver discourses, or lectures, at the first annual meeting in October, on such subjects as they may severally select:

Mr. McIlhenny of Washington, D. C.
Dr. J. Lawrence Smith of Louisville, Ky.
Mr. Smedberg of San Francisco.
Mr. Williams of Philadelphia.
Mr. Prof. Wurtz of New York.

By Mr. McIlhenny—*Resolved*, That the thanks of this Association are due to Gen. Chas. Roome, for the ability and dignity with which he has presided over its meeting.—Carried, with great applause.

Adjourned to meet in General Session on the third Wednesday in October, 1873, at 10 A. M., at such place as shall be designated by the President.

* It is to be understood, of course, that the minute here given of the proceedings is greatly condensed, and many things of no small importance had to be omitted, for conciseness.—H. W.

OUR NEW NATIONAL ASSOCIATION.

Readers of this Journal must recall the earnest and repeated efforts put forth in its columns, during a few years past, to bring about the great consummation which is now palpably before us; and which marks a new era in the history of gas in America. By this event is now opened to us a future, whose possibilities of good are dependent only on the zeal of those charged with the duty of their development.

The undersigned deems the high honor that has been conferred upon himself, in his election as Secretary of the Association, as an acknowledgement of these efforts, rather than of any special fitness or merit of his own. He adopts this general medium of communication with the American Gas Fraternity, to render his thanks to them collectively, for this action on the part of the representative men who met here during the last month.

It will be his part to prove, so far as in him lies, that the honor will not be unmerited in the future.

HENRY WURTZ.

The "NEWEST GAS-MIRACLE" AGAIN

In the April number of the *Manufacturer and Builder* Dr. Van der Weyde* alludes corteously (for which we thank him) to our late editorial headed as above. He attempts to justify the statement that 1000 feet of gas is derivable from one gallon of liquid, by the suggestion that this so-called gas may be merely naphthalized air. In the original paragraph however, quoted by the Doctor (which he admits he only inadvertently omitted to credit and comment on) and from him by us, "dissolved resin" is spoken of as an ingredient, which is incompatible with his supposition. Moreover, one gallon of naphtha would but very poorly naphthalize 1000 feet of air. From double to quadruple this proportion is required before the air will give any light when burned from common jet burners. That s, without a chimney.

By the way, we observe in a recent issue of a contemporary, a little calculation, which has a bearing on the recent revivals of the obsolete scheme of lighting cities according to the Mansfield invention. In London and Dublin it has been promulgated by the promoters of this absurdity that one gallon of naphtha will render luminiferous 800 feet of air, which is not correct, but admitting this, it follows that Dublin would require 900,000 gallons of naphtha per year, and one company alone in London (the Chartered) would require, if supplying naphthalized air instead of gas, three and a quarter millions of gallons per year. Now, we have to add that, as the proportion of such naphtha obtained from the crude oil is not more than ten per cent., this would be equivalent to 812,500 barrels of oil, or more than 40 days present product of the Pennsylvania oil region. At a more reasonable estimate of 3 gallons of naphtha equivalent to 1,000 feet of coal gas, the present consumption of New York city alone would require five months product of the Pennsylvania region.

Dr. Van der Weyde says also that the paragraph that led to this little "friendly fight" relates to the "Silber inventions"; which we think cannot be so, as our impression about these latter inventions is that they relate to quite different matters.

PRICE OF GAS IN SAN FRANCISCO.

"Gas is $4 a thousand in San Francisco, having risen from $1.50 to that figure in two months, in consequence of a consolidation of all the companies into one huge corporation."—*Daily Paper.*

This item may not be false in fact, but it certainly is so far as regards the impression intended to be produced upon the public. The low price spoken of must have been a ruinous one, considering that gas coals cost about double as much there as in New York, and the rise in price on cessation of competition was therefore merely a rise to the natural remunerative level.

NEW ENGLISH EXCHANGES.

We congratulate our readers and ourselves on two important new acquisitions in this respect, which have come to us without solicitation. To this fact we can certainly point with pride as a proof that the status of the AMERICAN GAS-LIGHT JOURNAL is acknowledged, abroad as well as at home.

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It is crammed throughout with information, scientific and technical, of the most valuable character; and we shall draw often and largely upon the treasury.

The *Journal of the Society of Arts*, of London. This is another journal, whose recent proposal to exchange we regard as very complimentary. The number for March 14, the only one as yet received, is chiefly taken up with the subject of signalling at sea, to obviate disaster, with special reference to the terrible collision of the North-fleet, which has been of late driven out of our minds on this side of the ocean, by the still more heart-rending catastrophe of the White Star Steamer Atlantic.

* Begging the pardon of our readers for what seems an unavoidable egotism, this seems the proper place to say that the learned Doctor has here, as on previous occasions, conferred on the Editor of this Journal an honor wholly unmerited and far from being coveted: namely, in Germanizing his name, by omitting one essential letter therefrom. To cut so personal an allusion as short as possible, the present writer would but add that even if it be deemed necessary to admit a German origin for his name, this origin must probably be sought for as remotely in the past as that of the learned Doctor himself.—H. W.

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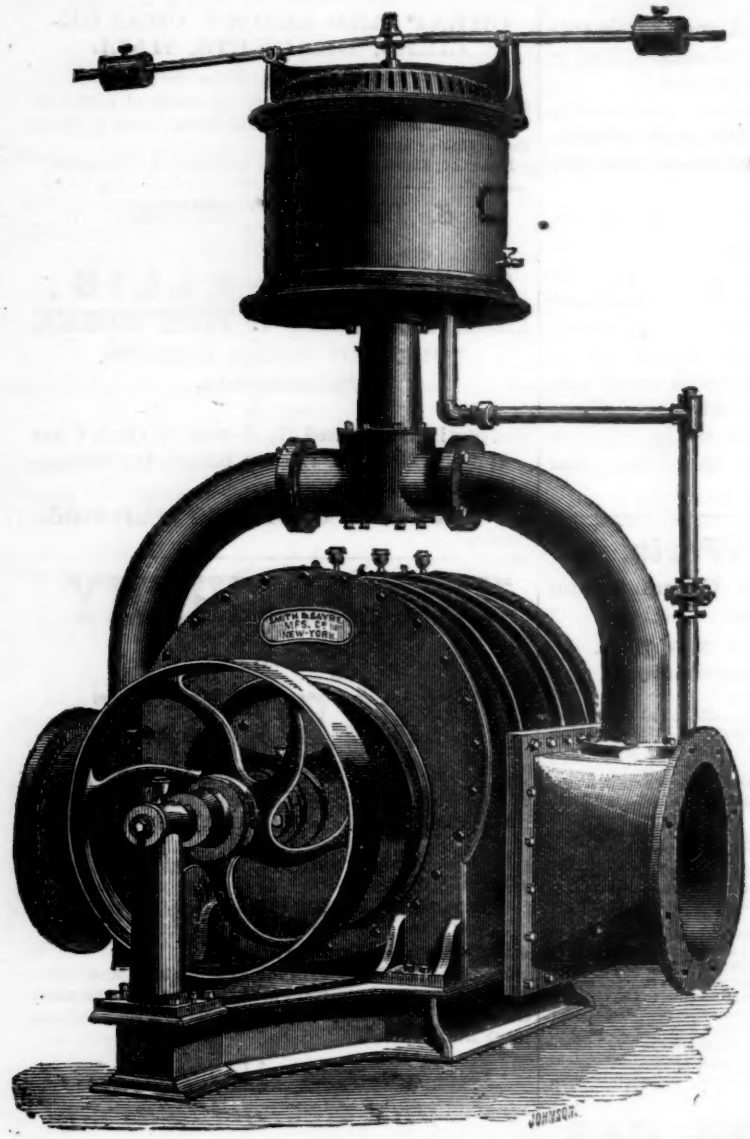

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The advantages of the screen are:

1st. The large purifying surface, the construction of the Screen giving over three-fourths of the surface for the gas to penetrate the lime.

2d. On account of the free passage of the gas through the Screen the pressure is reduced, thereby preventing the accumulating of carbon on the retorts.

3d. The saving of lime and labor, as the Screens are not liable to clog, and are easily cleaned.

4te Their cheapness and simplicity of construction.

5th. Their DURABILITY—they can be used longer than any other now used.

Testimonials.

PROVIDENCE, RHODE ISLAND, March 21st, 1872

E. DUFFEE, Esq., Agent, etc.

Dear Sir: The Trays manufactured by you for our West Station were put in use in September last, and have *given perfect satisfaction.*

The frames are well put together, and I see no reason why they will not last for a long time. The *very large amount of open space* in these Trays gives the gas an easy passage, and brings it into contact with the lime much better than when the space is so contracted, as is the case in most of the other Trays in use.

The pressure thrown upon the retorts by contracted passages is very great, and were gauges used more frequently than they now are in many gas-works, this facat of having *open Trays* would become more apparent to mangers of gas works. The digerence in pressure at this station in passing the gas through your purifiers, is two-tenths (2-10) inches.

The amount of gas purified. per bushel of lime used to this date, is six thousand five hundred and fifty six (6,556) cubic feet.

Respectfully yonrs,
JAMES H. ARMINGTON, Supt.

BOSTON GAS-LIGHT CO., Dec. 1871.

Dear Sir: In answer to your inquiry how we like your Patent Tray for dry gas purifiers, I take pleasure in saying we have used them exclusive of all others, for the last three years. and think them far ahead of any yet offered. The surface being nearly three times that of any other Tray, and their lightness and durability perfectly satisfactory.

Yours respedtfully,
A. M. GILES.

EDWARD DUFFEE, Esq.

EAST BOSTON, JUNE 15, 1871.

Gentlemen: We have used your Screens some five years. They give perfect satisfaction.

I consider them *by far the best Screen* for Dry Lime Purifiers I have seen. Yours truly, A. M. NORTON, Supt.

CHELSEA, May 1, 1871.

Mr. E. DUFFEE.

We are using your Purifying Trays, and find them to be the *best of any* that I have used, and will *purify more gas with less pressure* than any tray that I know. I can fully recommend them, after four years trial, to any Gas Superintendent with perfect safety, as the *cheapest and best Tray made.*

Yours truly, JOHN ANDREW, Sup't.

DORCHESTER, March 9. 1870.

Mr. E. DUFFEE.

Dear Sir: We have had your Gas Trays in constant use for almost one year and six months, and find them superior to any others we have ever used, both in point of economy and efficiency. Truly yours, W. B. BROOKS,
Agent Dorchester Gas-Light Co.

JAMAICA PLAINS, MASS., June 21, 1871.

EDWARD DUFFEE, ESQ.

Dear Sir; The Trays ordered by this company three years ago, are getting somewhat worn. I wish to say here that I consider your Trays to be superior to any yet invented, therefore please make us another set at the price named, to be like the sample shown in every way, and oblige Yours truly
JAMES F. ROGERS,
Sup't Jamaica Plains Gas-Light Co.

BROOKLINE, June 11, 1871.

E. DUFFEE, ESQ.

Dear Sir: You will please make a set of Gas Trays for this company as soon as convenient, at price named. In regard to the merits of the Tray, after having them in constant use for over two years, I will say that I consider them *superior to any Tray* manufactured in this country. Respectfully yours,
H. A. ALLYN,
Sup't Brookline Gas-Light Co.

BANGOR, August 2, 1870.

EDWARD DUFFEE, ESQ.

Dear Sir: Yours of the 20th ult. is received. In regard to your Gas Trays, I take pleasure in saying that they have been in use over two years, and have given perfect satisfaction' and they are in good order at the present time; should have no hesitation in recommending them, believing they are the most durable and easiest kept in order of any with which I am acquainted. Respectfully yours,
W. H. PERRY, Sup't.

OFFICE OF THE SPRINGFIELD GAS-LIGHT CO.'
SPRINGFIELD, MASS., Oct. 10, 1871.

Mr. WARD,
President Hartford Gas-Light Co.

Dear Sir: I have been using Gas Screens made by the American Gas Screen Company, for nearly a year, and find them superior in every way to the wooden Screens made and foimerly used by the Springfield Gas-Light Co. I can purify more gas with the same quantity of lime, there being more surface to the Screens; and I consider them more durable, and recommend them to your consideration.

Yours with great respect,
GEORGE DWIGHT.

ROXBURY, June 14, 1872.

EDW. DUFFEE, ESQ.

Dear Sir: In answer to your inquiry regarding your Patent Gas Screens, I am happy to be able to say, that after nearly three years constant use we are perfectly satisfied with them being able to purify over fifty pet cent. more gas with them, than with any other Screen we have used.

Yours respectfully,
THOMAS J. PISHOU.

OFFICE DETROIT GAS-LIGHT CO.,
DETROIT, MICH., April 22, 1872.

AMERICAN GAS SCREEN MANUFACTURING CO., HAVERHILL.

Gentlemen: The Screens bought of you work far better than any we have ever used. As a proof, we have with the same quantity of lime purified *twenty per cent.* more gas with your Screens than with any others, and the work well done. The workmen are also better pleased with them—they being light and handy to work. They also relieve the pressure very much upon the retorts, and I cheerfully give yau my experience. Yours truly,
P. E. DEMILL. Secretary.

We give a list of some Gas-Light Companies using them.

Providence, R. I. Gas-Light Co., Boston, Mass. Gas-Light Co.: East Boston, Mass., Gas-Light Co.; South Boston, Mass., Gas-Light Co.; Springfield, Mass., Gas-Light Co.; New Bedford, Mass., Gas-Light Co.; Manchester, N. H., Gas-Light Co.; Reading, Penn., Gas-Light Co.; Biddeford, Me., Gas-Light Co.; Hartford, Conn., Gas-Light Co.: New Haven, Conn., Gas-Light Co.; New Orleans, La., Gas-Light Co.; Savannah, Ga., Gas-Light Co.; Charleston, S. C., Gas- Light Co.; Trenton, N. J., Gas-Light Co.; Charlestown, Mass., Gas-Light Co.; Dorchester, Mass., Gas-Light Co.; Chelsea, Mass., Gas-Light Co.; Baltimore, Md., Gas-Light Co.; Manhattan, N. Y., Gas-Light Co.; Cincinnati, Ohio.; Gas-Light Co.: San Francisco, Cal., Gas-Light Co.: Albany, N. Y., Gas-Light Co.; Sacramento, Cal.; St. Joseph, Mo., Gas-Light Co.; Leavenworth, Kansas, Gas-Light Co.; Macon, Ga., Gas-Light Co.; Roxbury, Mass., Gas-Light Co.; Lansinghburg, N. Y., Gas-Light Co.; Bridgeport, Conn., Gas-Light Co.; Stamford, Conn., Gas-Light Co.; Poughkeepsie, N. Y., Gas-Light Co; Scranton, Penn., Gas-Light Co.; Lewiston, Me., Gas-Light Co., and one hundred others.

Address **A. P. JAQUES, Treas.,**
Amer. Gas Screen Man'f'g Co., Haverhill, Mass

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IN THE

Manufacture of Coal Gas,

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Orders for fitting up Valves of any desired form or patent, *subject to the generality of the Gibson claim*, and also for SUPPLIES and MATERIALS of every description required for the use of Gas Light Companies promptly attended to by

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REFERENCE.—RICHARD MERRIFIELD, Esq., late Vice President MANHATTAN GAS-LIGHT COMPANY.

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ARCHITECT AND GENERAL GAS ENGINEER,

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C. VANDERVOORT SMITH, Engineer Manhattan Gas-Light Company, N. Y.
CHARLES MOWTON, Engineer New York Gas-Light Company, N. Y.
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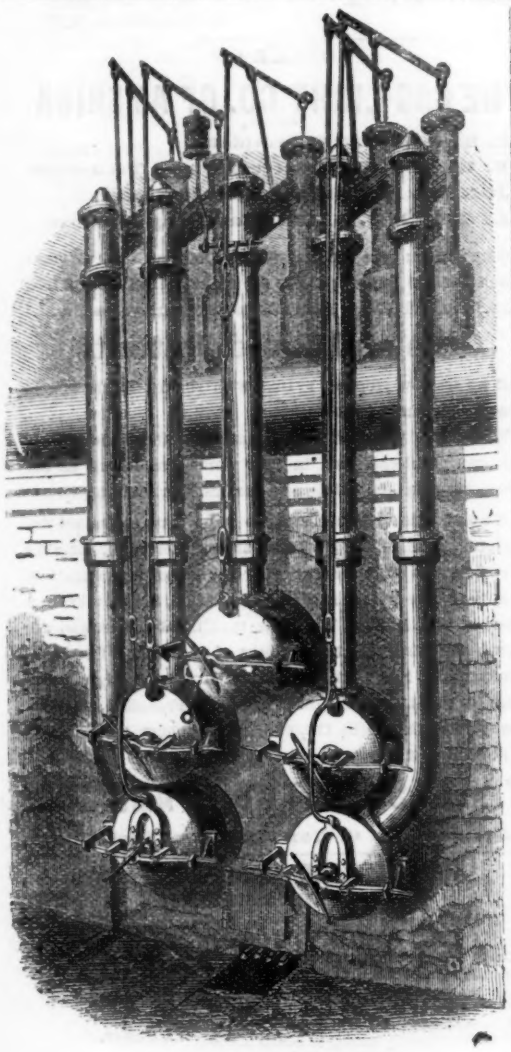

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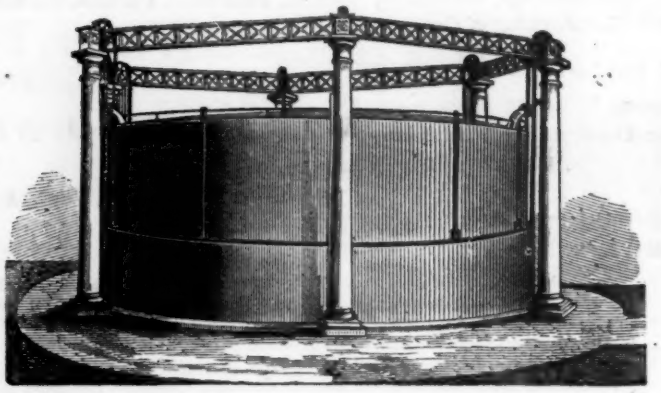

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E. W. McGINNIS, Secretary and Treasurer.
JOHN P. KENNEDY, Chief Engineer.
LEONARD D. GALE, Consulting Chemist.

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Gale and Rand Patents,

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We are also prepared to contract for putting said process into successful operation in your works, furnishing all the necessary plans, materials, and workmen for that purpose.

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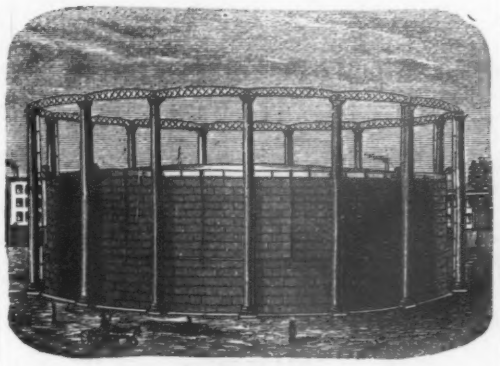

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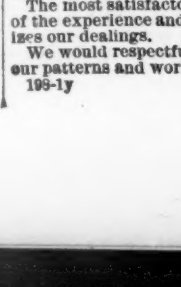

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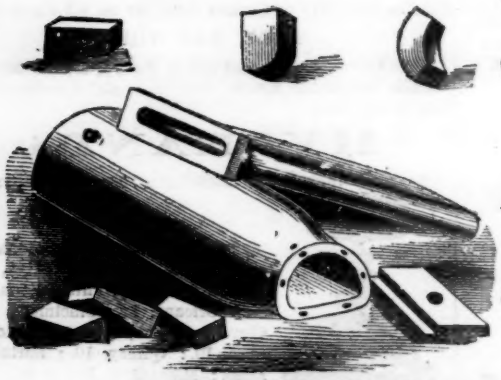

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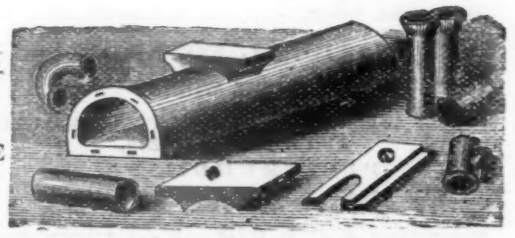

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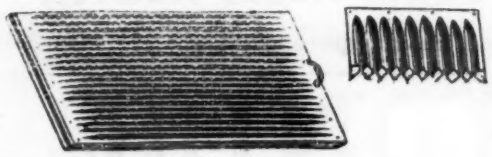

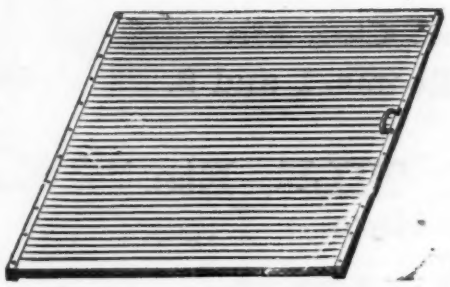

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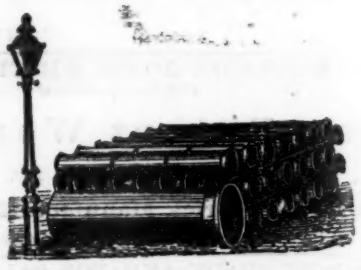

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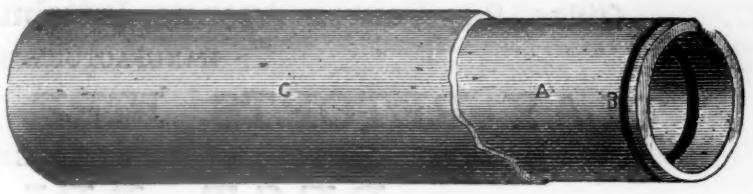

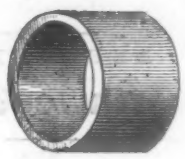

FIG. 2.

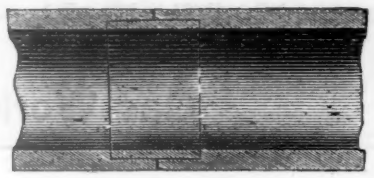

FIG. 3.

A—Cylinder of Wood. B—Band of Iron. C—Coating of Hydraulic or Asphaltum Cement.

FIG. 2.—Thimble for Connection. FIG. 3—Horizontal Section and Connection.

Above is a cut of the

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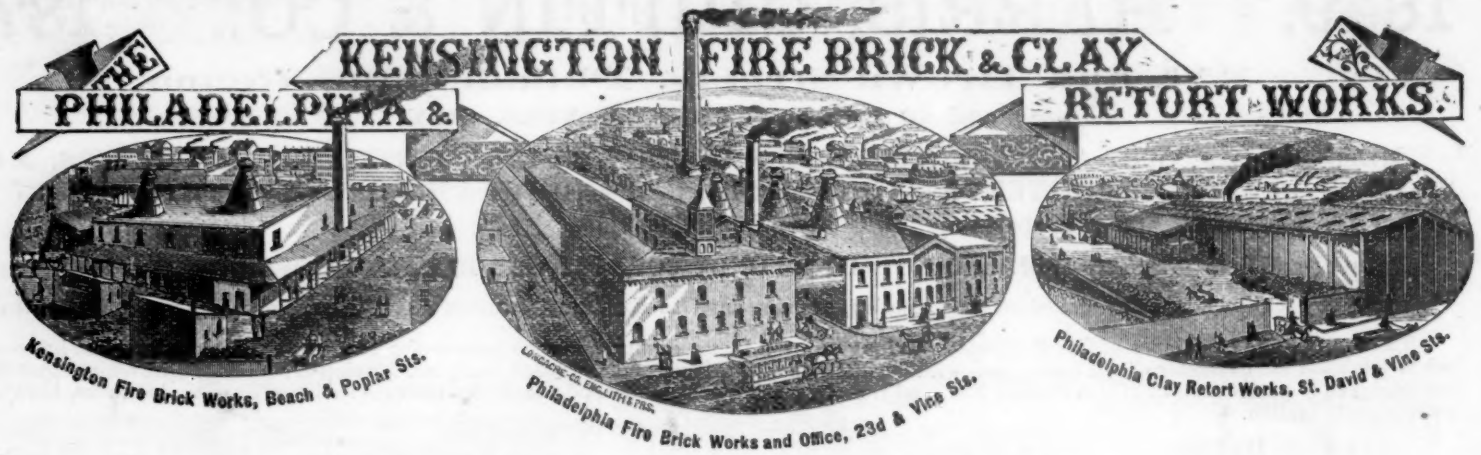
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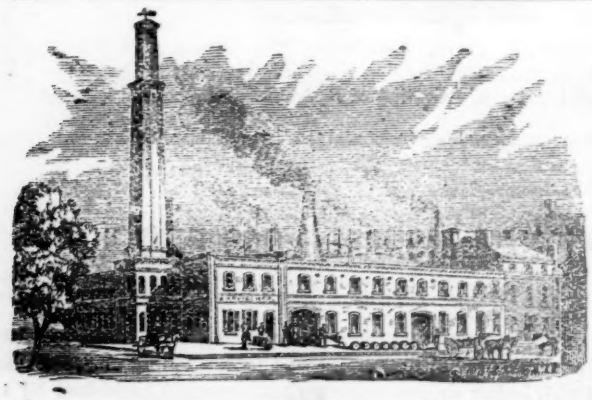

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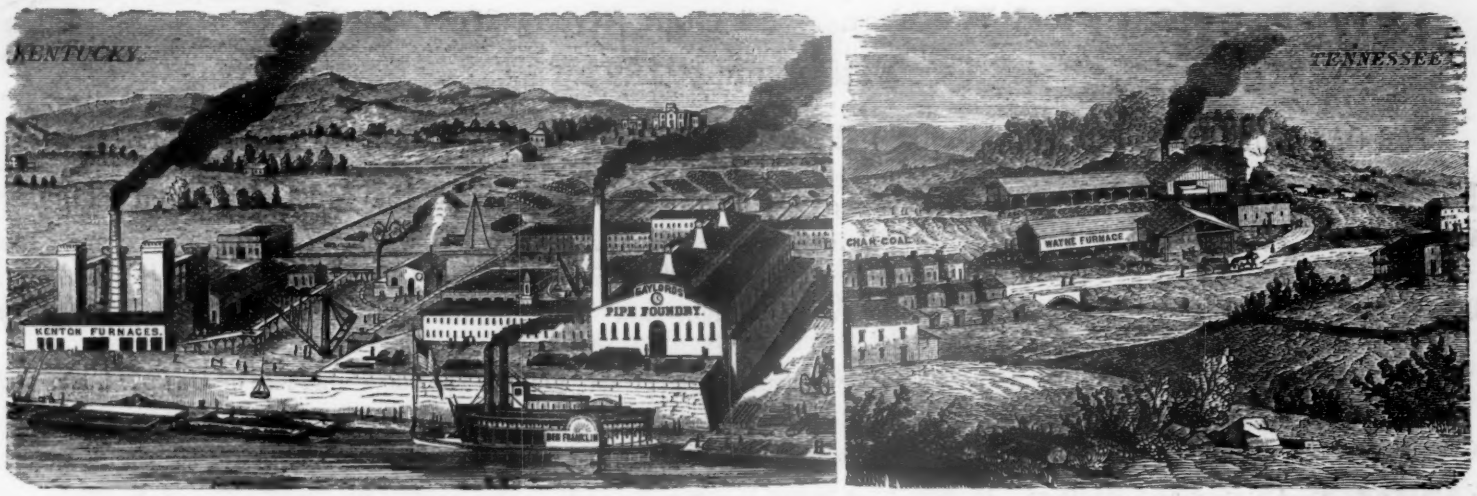

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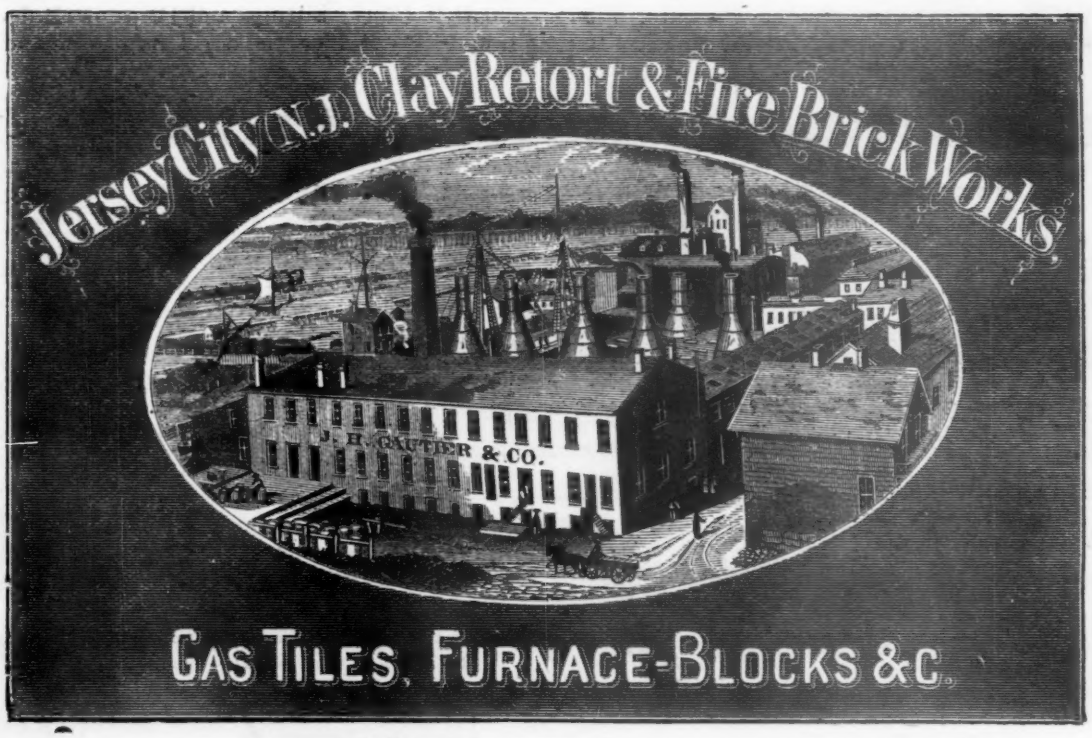

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Sec'y Wooster Gas-Light Co.

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CARRIAGES.—Movable Lifting Carriages for Purifiers, arranged either for Floor or Overhead use.

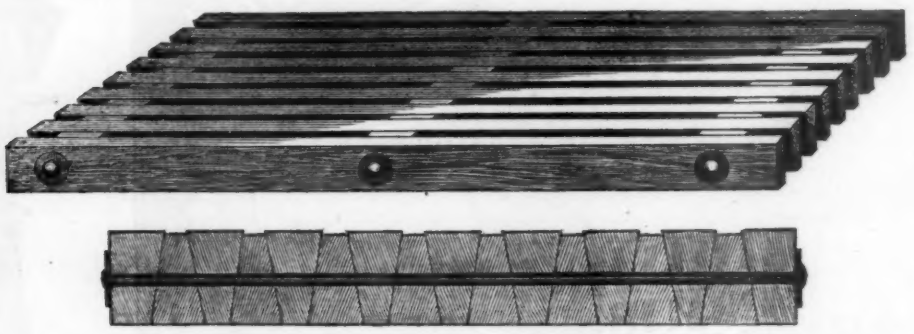
METERS.—Square and Round Meters of any capacity.

GAS HOLDERS.—Single Lift and Telescopic Gasholders, with Cast or Wrought Iron Suspension Frames.

GAS GOVERNORS.—Station Governors, with Regulating and Indicating Columns for Inlet and Outlet Pipes, also Dry Governors with Flexible Diaphragms for Underground Pipes.

STOP VALVES.—Double Faced Stop Valves for Gas or Water, from three inches to forty-eight inches diameter. These Valves are proved on both sides, with a heavy Water Pressure, Flange and Bell Pipes, Fittings and Drips of all descriptions. Steam Boilers and Hot Water Apparatus for Heating Building, and Gas Holder Tanks. Lamp Posts and Lanterns.

P. Munzinger's Patent Ash Lime Trays.



In use at the following Gas-Light Companies:

Pittsburg Gas Company, Pa.
Peoples Gas Company, Baltimore.
Lowell Gas-Light Company, Mass.
Lynn Gas-Light Company, Mass.
Albany Gas-Light Company, N. Y.
Schenectady Gas-Light Company, N. Y.
Utica Gas-Light Comwany, N. Y.
Jersey City Gas Company, N. J.
St. Paul Gas-Light Company, Minn.
Cumberland Gas-Light Company, Md.
Hartford City Gas-Light Company, Conn.
Richmond Gas Company, Va.
McKeesport Gas Company, Pa.
Middletown Gas Company, Pa.
East Newark Gas-Light Company, N. J.
Binghampton Gas Company, N. J.
Zanesville Gas Company, Ohio.

New Orleans Gas Company, La.
Salem Gas-Light Company, Mass.
New Britain Gas-Light Company, Conn.
Rahway Gas-Light Company, N. J.
Trenton Gas-Light Company, N. J.
Elmira Gas Company, New York.
Erie Gas Company, Pa.
Columbus Gas-Light Company, Ohio,
Westchester Gas-Light Company, N. Y.
Santa Cruz Gas Company, Cal.
Lawrence Gas-Light Company, Kansas.
Salem Gas Company, N. J.
Indiana Gas-Light Company, Pa.
Peoria Gas Company, Ill.
Montclair Gas Company, N. J.
Williamsport Gas Company, Pa.
Wooster Gas-Light Company, Ohio.

Augusta Gas-Light Company, Ga.
Huntsville Gas Company, Ga.
Chattanooga Gas Company Tenn.
Murfreesboro Gas Company, Tenn.
Hagerstown Gas-Light Company, Md.
Hanover Gas Company, Pa.
Easton Gas Company, Pa.
Uniontown Gas-Light Company, Pa.
Coatesville Gas-Light Company, Pa.
Houston, Gas Company, Texas.
Wilkesbarre Gas Company, La.
Middletown Gas Company, New York.
Washington Gas-Light Company, Pa.
Princeton Gas-Light Company, N. J.
Newark Gas Company, Ohio.
Pontiac Gas-Light Company, Mich.
And numerous other Companies.